Giving Broilers a Firmer Leg To Stand On

Today's broiler chickens are bred for fast growth—and their growth rate is now almost double that of 30 years ago. Consequently, the bones do not have enough time to mature and grow properly. Producers are plagued with lame birds, their lameness attributed to leg deformities, broken bones, and inflammation-causing bone infections.

Tackling this problem is Narayan Rath, a poultry physiologist in the ARS Poultry Production and Product Safety Research Unit at Fayetteville, Arkansas. He is trying to establish methods that will reduce the incidence or severity of bone-related problems that cost the poultry industry millions of dollars in losses each year. Rath says reducing leg problems in poultry will save money for the industry and eventually for consumers.

He is studying a major metabolic bone disorder known as tibial dyschondroplasia, or TD.

"The ends of long bones are made up of cartilage, a type of connective tissue responsible for long-bone growth in young birds. It is gradually replaced by bone, until growth ceases," says Rath.

But TD impedes cartilage replacement by bone. This causes the tibia—the inner, larger bone just below the knee—to be soft and fragile and prone to deformities and breakage.

In laboratory tests, Rath found that cartilage cell death in the growth plate near the ends of the bones prevents the cartilage tissue from being replaced by new living cells and bone tissue. Instead, it remains as an island of dead cartilage surrounded by living cells.

"We didn't have this knowledge before. And even though we don't know the cause of this cell death," says Rath, "the finding at least provides a major clue in searching for agents that cause abnormal cell death in the tibial growth plate. It also allows us to focus on specific ways to suppress this process."

Rath notes that certain mineral nutrients prevent cell death in lab tests, but researchers have not tried them in animal experiments.

Rath is also looking at ways to increase bone maturity and strength during its growth period. Bone contains both inorganic mineral and organic components. The inorganic part is mostly calcium and phosphorus and constitutes 65 to 70 percent of bone weight; the organic part is mostly collagen—a fibrous protein.

Bone strength is related to its density and mineral content. Chemical bonds called cross-links tie collagen fibers to each other, significantly increasing collagen strength and eventually bone strength.

"We are now examining these collagen cross-links from birds of both sexes and different ages," Rath says. "We want to learn more about bone strength as related to the cross-links, bone minerals, and other biochemicals."

Rath says researchers don't know if the cross-links can be enhanced to increase bone strength.

"We know that steroids such as androgen can enhance bone strength, but we'll be looking for some cost-effective nutritional manipulations to achieve these objectives," he says. "We may have a long way to go."—By **Tara Weaver,** ARS.

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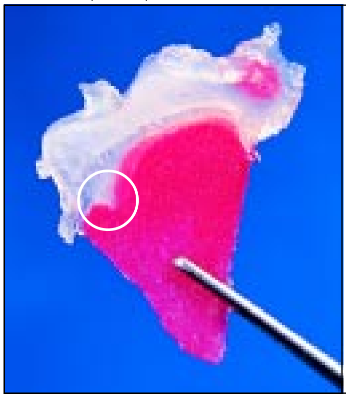

An indentation of cartilage from the growth plate border into the bone (red, dyed area)—usually a smooth arc—indicates a growth abnormality from tibial dyschondroplasia.

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Technician David Horlick (left) and poultry physiologist Narayan Rath prepare to analyze collagen cross-links made of a fibrous protein.